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Original Research Article

Physicochemical and bacteriological status of retail-marketed shrimps and crabs in Beni-Suef, Egypt

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ABSTRACT

A total of a hundred and twenty samples of crustaceans, 60 samples of shrimp (30 peeled & 30 unpeeled shrimps) and 60 samples of local chilled crab were collected from Beni-Suef markets. Collected samples were evaluated by the physicochemical deteriorative criteria (pH and TVB-N), the bacterial load determination (mesophilic count, psychophilic count, Staphylococcus aureus count and MPN of coliforms, faecal coliforms and E. coli), and isolation and identification of specific pathogens (E. coli, and Staphylococcus aureus). All fresh and frozen seafood samples were judged as safe food from the microbiological point of view. The total mesophilic, psychophilic and S. aureus for all examined seafood samples lies within the standard permissible limits recommended by national and international agencies. The suggestive measure for produce high-quality shrimp & crab was recommended.

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1. Introduction

Seafoods, including crustaceans, represent an important part of a healthful diet due to their high-quality protein content, vitamins, minerals and high levels of polyunsaturated fatty acids named omega-3 fatty acids (Okonko et al., 2009). Besides, the seafood proteins are easily digestible because of their less connective tissue (FDA, 2009). On the other hand, seafoods including crustaceans are highly perishable due to less acidic muscle pH, highly active muscular enzymes and high levels of unsaturated fatty acids, consequently they are susceptible for microbiological, chemical, and physical changes during postmortem storage (Nirmal and Benjakul, 2010). In addition, they are subjected to contamination at during various stages of handling and processing. Raw sea food products, water and utensils used may lead to contamination of seafoods (Inabo et al., 2000). Processing and packaging are done mainly by workers with poor sanitary conditions (Oranusi et al., 2003). The quality deterioration of sea foods can be assessed by sensory evaluation, chemically by pH, as well as bacteriologically by enumerating spoilage microorganisms especially Coliforms, *Pseudomonas*, isolation and identification of pathogenic microorganisms (Zuberi et al., 1981; Chen et al., 1990; Ramachandran et al., 1997 and Al-Dagal et al., 1999). Several reports recorded that contamination of seafood with *Staphylococcus aureus*, *coliform* bacteria and others lead to health risks ranging from allergy reaction, stomach and intestinal growths, a general degeneration of peripheral cellular tissues, to gradual break down of the digestive and excretive system, abdominal cramps, vomiting, chills and fever (Acha and Szyfres, 1991; Varnam and Evans, 1991; Gracey et al., 1999; Ekholm and Hirshfield, 2001; Edema et al., 2005). So far, there have been many studies on the microbiological quality of Crustacean (Ray et al., 1976; Ward et al., 1977; Wents et al., 1985; Gecan et al., 1988; Ingham et al., 1990; Segner, 1992; Chung and Cadwallader, 1993;

Chen et al., 1996; Gimenez and Dalgaard 2004; Fath El-Bab et al. 2010 and Nada et al. 2014). Therefore, the present study was aimed to evaluate the Quality parameter of some shrimp and crab.

2. Materials and methods

2.1 Collection of samples:

A Total of One Hundred and Twenty samples of Crustaceans, 60 samples of Shrimp (30 of peeled shrimp & 30 of unpeeled shrimp) and 60 samples of local chilled Crab were collected from Beni-Suef markets. The collected samples were identified and directly transferred in an insulated ice box to the laboratory with minimum of delay to be examined within 6 hours from collection.

The pH was determined according to the method recommended by Korkeala et al. (1986).

2.2 Quality parameters:

Total volatile basic nitrogen TVB-N (mg N/100 g) was measured according to the method recommended by FAO (1986).

2.3 Bacteriological examination

Preparation of the of collected samples was done according to the muscle maceration technique recommended by ICMSF (1986) as follows:

Ten grams of samples was removed using sterile scalpel and forceps and transmitted to a sterile homogenizer flask containing 90 ml of 0.1% sterile peptone water (DM185D, MAST, UK). The contents were homogenized at 2000 rpm for 2.5 minutes using a sterile homogenizer (MPW 302, Universal Laboratory Aid, made in Poland). The homogenate was allowed to stand for about 15 minutes at room temperature. The contents represented the dilution 10^{-1} were thoroughly mixed by shaking, one ml was aseptically transferred using a sterile pipette into a sterile test tube containing 9 ml of 0.1 % sterile peptone water to be diluted in a

sequential manner by ten-fold serial dilution up to 10^{-6} .

Aerobic plate count (APC) at 35 °C for Mesophilic count and at 7 °C for Psychrophilic count and coliforms MPN (3 tubes method) were performed on lauryl sulphate broth for 24 to 48 hours as well as Fecal coliforms on E.C. broth for 24 to 48 according to the techniques recommended by AOAC (1990).

Samples for *Staphylococcus aureus* were spread plated on a Baird Parker agar and incubated at 35 °C for 48 h. Typical colonies were confirmed using tube coagulase test (AOAC, 1995).

3. Results

In this study, table (1) showed that the mean values of pH in the examined samples of Unpeeled shrimp, Peeled shrimp and crab were 6.346, 6.590 and 6.62, respectively while the mean value of TVB-N in the examined samples of Unpeeled shrimp, Peeled shrimp and crab were 21.348, 24.787 and 23.78 mg/100g respectively. Table (2) revealed that the mean aerobic bacterial counts at 35°C & 7°C of the

examined unpeeled shrimp samples were 10^4 and 8×10^4 CFU/g, respectively. In the same table, the mean values of coliforms (MPN), fecal coliform (MPN) and *E. coli* (MPN) for shrimp were 4×10 , 17 and 4 cells/g, respectively. While The mean values of *S. aureus* count for imported un peeled shrimp was 2×10^3 CFU/g. Table (3) revealed that the mean aerobic bacterial counts at 35°C & 7°C of the examined Local peeled shrimp samples were 1×10^5 and 9×10^4 CFU/g, respectively. In the same table, the mean values of coliforms (MPN), fecal coliform (MPN) and *E. coli* (MPN) for shrimp were 5×10^2 , 5×10^2 and 11 cells/g, respectively. While The mean values of *S. aureus* count for local peeled shrimp was 4×10^3 CFU/g. Additionally, Table (4) revealed that the mean value of APC at 35°C and APC at 7°C of the examined crab samples were 2×10^5 and 6×10^4 CFU/g, respectively. Moreover, the mean values of coliforms (MPN), fecal coliform (MPN) and *E. coli* (MPN) for examined crab samples were 3×10^2 , 4×10^2 and 4 cells/g respectively. While The mean values of *S. aureus* count in crab was 2×10^3 CFU/g.

Table (1): Statistical analysis of the chemical criteria of the examined samples.

Crustacean	Number of Samples	criteria	Minimum	Maximum	Mean	S.E.
Crab	60	PH	6.08	7.81	6.62	0.089
		TVB-N mg%	18.33	29.06	23.78	0.69
Peeled Shrimp	30	PH	6.220	20.340	6.590	0.04349
		TVB-N mg%	6.690	28.600	24.787	0.9517
Unpeeled shrimp	30	PH	6.080	14.000	6.346	0.06804
		TVB-N mg%	6.700	25.540	21.348	1.273

Table (2): Statistical analysis of the bacterial count (CFU or cells/g) of the examined Imported unpeeled shrimp samples.

Criteria	Minimum	Maximum	Mean	SE
Mesophilic count	10^3	6×10^4	10^4	4×10^3
Psychrophilic count	10^3	9×10^5	8×10^4	4×10^4
Coliforms (MPN)	3	150	4×10	10
Fecal coliforms (MPN)	3	93	17	6.
<i>E. coli</i> (MPN)	3	23	4	1
<i>S. aureus</i> count	$<10^2$	7×10^3	2×10^3	5×10^2
<i>S. aureus</i> count	$<10^2$	7×10^4	4×10^3	3×10^3

Table (3): Statistical analysis of the bacterial count (CFU or cells/g) of the examined crab samples.

Criteria	Minimum	Maximum	Mean	SE
Mesophilic count	1×10^3	7×10^5	2×10^5	3×10^4
Psychrophilic count	10^2	3×10^5	6×10^4	1×10^4
Coliforms (MPN)	3	1.1×10^3	3×10^2	65.360
Fecal coliforms (MPN)	3	1.1×10^3	4×10^2	72.866
<i>E. coli</i> (MPN)	3	23	4	0.6804
<i>S. aureus</i> count	$<10^2$	8×10^3	2×10^3	4×10^2

5. DISCUSSION

From table (1) showed that the mean values of pH in the examined samples of unpeeled shrimp, peeled shrimp and crab were within the permissible limit (6.5:7) recommended by FDA (2007). The obtained results were nearly similar with Fath El-Bab et al. (2010), Gimenez and Dalgaard (2004) and Nada et al. (2014). There is a relationship between the increase of pH value and the deterioration of food compounds

produced as a result of microbial activity and enzymatic autolysis, could cause the increases in pH, this in accordance with that reported by Huss et al. (2000). the mean value of TVB-N in the examined samples of unpeeled shrimp, Peeled shrimp and crab were 21.348, 24.787 and 23.78 mg/100g respectively which were within the permissible limit (30 mg /100 g) recommended by ES (2005). These results also similar nearly with Fath El-bab et al. (2010), Kyrana and Lougovois (2002) and Nada et al (2014). In this respect, Montgomery et al. (1970) reported that the maximum limit of

acceptability of TVB content of peeled shrimp in Australia and Japan was 30 mg /100 g. Whereas, Wibowo et al. (1992) considered a level of TVB-N of 30 mg/ 100g as a limit of acceptability for industrial purposes. Furthermore, they added that fishy odor started to develop when the TVB-N was 30.44 mg N% and the development of putrefactive odor was accompanied by a value of 31.88 mg N%. On the contrary Yamagata and Low (1995) recorded that TVB-N level of 12.11 and 14.48 mg N% were enough to develop such a fishy and distinct urea odor in shrimp samples, respectively. From previous data, it could be concluded that TVB-N content of 30 mg N% is considered a specific limit of acceptability and 80% of the examined iced peeled shrimp in this study are considered acceptable, whereas, 100% of the samples should be considered acceptable according to the specified permissible limit (65 mg N%) given in the ES (1993). In addition, the present data concludes that the TVB-N was a good freshness index for the assessment of shellfish quality due to gradually increase in TVB-N with inclination to spoilage.

The mean aerobic bacterial counts at 35°C & 7°C of the examined unpeeled shrimp, peeled shrimp and crab samples were within the permissible limit (10^6 CFU/g) that recommended by ES (2005). These results nearly similar with that obtained by Fath El-bab et al. (2010). Consequently, the initial bacterial level at arrival to processing plant shall be considered a function of the quality and extent of storage of shrimp or prawn and a limit of up to 10^7 should be considered a critical limit at the arrival to the processing plant. From the present data, it could be concluded that shellfish are subjected to many risks of contamination from various sources. It is worth mentioned that the chief sources of shellfish contamination are sewage-polluted aquatic environment from which Shellfish were harvested, method of harvest and unsanitary handling practices of Shellfish during harvesting, distribution and marketing. respectively.

The mean values of coliforms (MPN), fecal coliform (MPN) and *E.coli* (MPN) for shrimp were 4×10^1 , 17 and 4 cells/g, respectively, while in peeled shrimp were 5×10^2 , 5×10^2 and 11 cells/g, respectively, On other hand table (4) showed that the mean values of coliforms (MPN), fecal coliform (MPN) and *E.coli* (MPN) for examined crab samples were 3×10^2 , 4×10^2 and 4 cells/g respectively. The permissible limit of coliforms (10^2 MPN /g) which is recommended by ES (2005) were exceeded by some of the examined shrimp and crab samples. The contamination of seafood by coliforms lead to clinical symptoms as diarrhea, nausea, vomiting, fever (Varnam and Evans, 1991). The mean values of *S. aureus* count for unpeeled shrimp, peeled shrimp and crab were below the permissible limit of (ES 2005) which is (10^3 CFU/g). These results Nearly similar with that of Nada et al. (2014), Fath El-Bab et al. (2010). Presence of *S. aureus* may be due to contamination of seafood from human sources, equipment during the handling and processing (Forbes et al., 1998).

6. Conclusions:

Approximately the most difficulties facing the shrimp and Crab are the short shelf life and quality deterioration rather than food poisoning. Therefore, in order to produce good quality crab and shrimp, they must be maintained at good storage chilling condition, protecting them from mishandling, physical damage and other sources of contamination

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